

SOSPITA SAVITRI (Abisara Savitri), *Felder, Wien. Ent. Monats.* Band iv. p. 397.

Sospita Susa, *Hewitson, Ex. But.* vol. ii. pl. 46. fig. 2. Sumatra; Singapore.

Gen. TAXILA, *Doubleday.*

TAXILA DRUPADI.

Emesis Drupadi, *Horsfield, Cat. Lep. E. I. C. Museum*, pl. 2. figs. 3, 3 a. Malacca; Sumatra; Singapore.

TAXILA ORPHNA, ♂, *Hewitson, Ex. But.* vol. ii. pl. 45. fig. 7.

Emesis Orphna, *Boisduval, Sp. Gen. Lep.* pl. 21. fig. 4.

Female. Above rufous-brown; anterior wing with the outer half carmine, crossed near the apex by a large orange spot. Below, as in the male. Sumatra; Singapore; Sarawak.

Var. Female. With a larger portion of the anterior wing carmine, the orange near the apex, the nervures and outer margin of the posterior wing carmine. Singapore.

TAXILA TELESIA, ♂, *Hewitson, Ex. But.* vol. ii. pl. 45. figs. 1, 2. Sumatra; Sarawak.

Female. Above, anterior wing carmine, marked by rays of dark brown: the base pale brown, crossed near the apex by a band of orange-yellow. Posterior wing rufous brown. Below, as in the male. Sumatra; Sarawak.

TAXILA TENETA, *Hewitson, Ex. But.* vol. ii. pl. 45. figs. 3, 4. Sarawak.

TAXILA PULCHRA, *Hewitson, Ex. But.* vol. iii., Taxila, ii. figs. 8-10.

Argynnis pulchra, Guérin, Voy. Coquil. pl. 16. figs. 2, 3. Waigiou.

TAXILA DECORATA, *Hewitson, Ex. But.* vol. iii., Taxila, ii. figs. 11-13. Aru; Dorey; Mysol.

Var. Male. Darker; the band of the anterior wing narrower, clouded. Dorey.

TAXILA THUISTO, *Hewitson, Ex. But.* vol. iii. pl. 45. figs. 5, 6. Sumatra; Singapore.

On the "Tsetse" Fly of Tropical Africa (*Glossina morsitans*, Westwood). By JOHN KIRK, M.D., F.L.S.

[Read Dec. 15, 1864.]

HAVING travelled in regions infested by the fly whose bite is reputed so deadly to cattle, I venture to bring before you a brief *résumé* of what is known regarding it, adding such observations as my own experience has suggested. I do so the more readily

as of late the statements brought forward regarding it have been called in question by men of science.

In 1850 Gordon Cumming drew attention to this subject*. He says that the natives tried to dissuade him from going further in the direction of the "Limpopo," telling him that he would lose all his cattle by a fly called the "Tsetse." In this region, I may remark, Captain Harris had, in 1837, marked on the map a "country abounding in flies destructive to cattle." Regardless of the double caution, Gordon Cumming advanced, and gives the following as his experience:—"The next day one of my steeds died of the 'Tsetse.' He had been bitten under the mountain-range lying to the south of the fountain. The head and body of the poor animal swelled up in a most distressing manner before he died; his eyes were so swollen that he could not see, and in darkness he neighed for his comrades who stood feeding before him."

Major Vardon next gave his experience. He had hunted about the same time and in the same region as Gordon Cumming. His statements regarding the fly are much more precise; and to him we are also indebted for the first specimens brought to Europe, which enabled Professor Westwood to describe the insect and determine its affinities†. Major Vardon further performed a most interesting experiment. Aware of the existence in certain districts of the Bechuana country of plants poisonous to cattle (such as the "Koñwhane," a species of *Lasiosiphon*), and suspecting that some such herb might be the cause of the mischief ascribed by the natives to the fly, he put the matter to the test by riding his horse into a "Tsetse"-infested part, without dismounting or allowing the animal to feed; the result was the death of the horse.

In a letter to Professor Westwood (*loc. cit.*) he says, "I fancy it is not met with south of the tropic of Capricorn; it is usually found on hills, plains being free from it. I have ridden up a hill and found the "Setse" increasing at every step, till at last forty or fifty would be on my horse at once. The specimens you saw cost me one of the best of my stud. He was stung by some ten or a dozen of them, and died in twenty days."

Mr. Oswell, one of the discoverers of Lake Ngami, and one of the first to reach the marshy regions of Central Africa on the Upper Zambezi, records what he observed regarding the "Tsetse"

* Five Years of a Hunter's Life in the Far Interior of South Africa, ii. pp. 210, 227.

† Proceedings of the Zoological Society of London, Dec. 10, 1850, and Ann. Nat. Hist. 2nd ser. x. p. 138.

in a communication made to the Entomological Society*. Here we find noticed almost every point which has yet been brought forward. It is stated that the fly is strictly localized, and not known to shift its ground; that during the heat of the day it is active, but does not bite by night, and that the natives then pass cattle without loss through "fly country." Mr. Oswell believes that three or four flies are sufficient to kill a full-grown ox. Similar appearances were found by him in the bodies of twenty oxen which died after being bitten. These were a watery and wasted state of the flesh; stomach and intestines healthy; heart, liver, and lungs—sometimes all, invariably one—diseased, the substance of the heart in particular being soft; the blood diminished in quantity, albuminous and thick, not staining the hands when plunged into it.

Mr. Oswell states that while man, the goat, and wild animals are bitten with impunity, as also calves sucking milk, other domestic animals perish; the symptoms being swelling of the eyelids, a watery discharge from the eyes, and considerable enlargement of the sublingual glands.

Dr. Livingstone, who accompanied Messrs. Oswell and Murray to Lake Ngami, and with the former experienced the fly on their way to the Makalolo country, makes frequent mention of the "Tsetse" in his 'Missionary Travels.' He amplifies and confirms what had been before stated, adding much to our knowledge of its habits and distribution. He mentions that the ass is not affected by the bite; and although the sucking calf lives, the dog fed on milk dies.

On one occasion Dr. Livingstone suffered a loss of forty-three of his oxen, and believes that not a score of flies were ever upon them. As an instance of the sharply-defined habitat of this fly, he gives that of the "Chobe," a stream fifty yards wide, on the north bank of which his cattle grazed in safety on pastures free from fly, while the south side was infested and had proved fatal, and this while the "Tsetse" was seen adhering to flesh carried across the stream in canoes.

Dr. Livingstone's most important observation is the connexion between the fly and large game, especially the buffalo and elephant, and its absence from parts where these do not exist, pointing to a possible means of ridding a country from this curse.

Other travellers in the south have encountered this fly, and all bring home the same tale.

* Transactions of the Entomological Society of London.

Captain Burton met with "Tsetse" between Tanganyika and the coast*; and the native name given to it by him very closely resembles that in use on the Rovuma river, where we found it abundant. Specimens, however, from the Lake regions are not to be found in the British Museum.

In reference to this I have been kindly favoured with the following note from Captain Burton:—

"I certainly sent the 'Tsetse' to the British Museum, and saw it there in 1860. The only proof that the fly in question (by which I was often stung) kills cattle, especially cows, is the universal report of the natives of different and distant tribes. One of our cows died in Unyamwezi, and all who saw her declared it was the fly's poison. I have told all I know about it in the 'Lake Regions.'"

(Signed) "R. F. BURTON."

During the Zambezi Expedition, the "Tsetse" fly has been met with by us on many occasions and at distant parts. It was first seen on the Zambezi at Lupata, a hilly and well wooded district 150 miles from the coast. To the north-east between the Zambezi and Shire it is very abundant. In some parts of the Batoka country, near the Victoria Falls, it was again found; also at the junction of the Chobe; and in immense numbers on the south bank, not far from the confluence of the Kafue.

On the Rovuma river in south latitude 10° it is met with eight miles from the coast, and extends along its banks for 115 miles, the furthest point explored; here we found it named "Chipanga;" "Kipanga" being that given to it at Kilwa, according to Capt. Burton. Wherever met with over this wide area of Tropical Africa south of the equator, the habits of this fly as recorded are the same.

It frequents open forest and well-wooded country, being absent from extensive grass plains. In the morning while the dew hangs on the grass, and before the heat of the rising sun has warmed the air, the "Tsetse" is dull and sluggish, resting on the under side of some leaf or blade of grass; when forced to take wing they may then be easily caught.

Even at nine o'clock they are not very active, and fly about with a peculiar buzzing sound; with the heat of the day they become a real annoyance to the traveller, constantly biting him on the hands, face, or neck, dextrously evading a blow, and again alighting on the very spot from which they have been driven. If permitted, they will gorge themselves with blood and become

* Lake Regions of Central Africa.

unable to fly to a distance. On man, the effects are not more than follow an ordinary mosquito bite, redness, swelling, and local irritation remaining for about an hour, varying in amount according to the state of the individual. In itself the bite is not so severe as that of the larger *Tabanidæ*.

By night I have never been bitten by "Tsetse," nor do they fly about after sunset. They are most numerous and troublesome in the hot sultry weather before rains.

When once the attention has been directed to the fly, it cannot again be overlooked, although, from its common and insignificant appearance, others might easily be confounded with it by those who have not before experienced it. There is therefore more danger of its geographical range being exaggerated than underestimated. Wherever I have found this fly, it has been accompanied by the buffalo or elephant; the native dog and goat are the only domestic mammals I have found in a country infested by it. Yet the English dog from the Cape is reported to have died like horses and cattle on entering the region, a difference perhaps due to breed.

The few instances I have known of oxen taken into "fly" country form no exceptions to the common experience, although, on their showing the first symptoms, they were slaughtered by us to save the flesh, which, when the animal is far gone, becomes uneatable even to savages who love butcher's meat and devour leopards, snakes, and unclean animals.

Although always found in company with large game, the fly does not follow it everywhere; other circumstances, still unknown, check its universal distribution.

Between Sesheke and Linyanti there is plenty of game, yet the fly is limited to certain narrow spots, and in like manner between Sesheke and the Victoria Falls. So are these falls shut out from the south by only a narrow belt of "fly" land, which may be crossed at night.

As much of what we know on these points rests on native information, I would remark that where the person obtaining it enjoys the confidence of the people and can speak with them in a common language, without depending on interpreters, native testimony on matters of fact is quite as good as European.

The Makalolo are a people from infancy accustomed to tend cattle, possessing a thorough knowledge of the most fattening pastures to be sought, and noxious herbs to be avoided. Their only wealth consists in cattle, which they number by thousands.

All affirm that on entering certain localities by day the oxen die shortly afterwards: this they have proved, not in the small numbers of twenty or forty noticed by Europeans, but in herds consisting of hundreds; whether in great or small numbers they have found the result alike. They have further learned that these deadly places may be crossed with safety by night if sufficiently narrow to allow of the cattle being driven through before sunrise. This has been tested by Europeans and found also correct; further, that goats remain unaffected; and sheep suffer in a less degree than oxen.

From observing a fly constantly present in these deadly parts, the natives have drawn the natural inference that it is the cause of the loss: nor indeed can I suggest a better theory; the fly is the only thing constant in all such parts, and absent from others with which we are acquainted. The fact that the sucking calf lives, while the mother dies, at once suggests the idea of some poisonous herb; Major Vardon's experiment, however, makes us doubt this; and the dog and cow both die, whose food is so unlike.

On the other hand, we find the confines of the fly and the disease exactly correspond; also when the fly is dormant no mischief ensues. The fly avoids human excrement, so the natives told us, and we have found it true, and they say that cattle have been passed by day through fly country when smeared with a composition containing this. Native doctors have an herb to which they attribute a similar effect, but even they never assert that it will save all; only a small per cent. of the cattle exposed is the most they claim.

It has been suggested that lung-sickness, African distemper, or some such disease is the cause of death. Is it likely that a number of intelligent men, all of whom had previously been acquainted with these diseases, should have failed to recognize them again? Besides, they differ manifestly from the "Tsetse" disease in being contagious and spreading from one place to another and from one animal to another, whereas only those bitten by the fly die; and no danger has been apprehended, or experienced, by such cattle mixing with others.

As to what that disease is I can say almost nothing. I have seen the animals become languid, lose flesh, droop the ears, swell at the eyes, which gave a discharge, the coat began to stave: as to the bites, they simply showed the smallest swelling, and a little moisture on the hair around. On dissection (the animals being killed when these first symptoms appeared) the flesh had in some

degree lost its firmness, and the lungs at base were engorged. The first symptoms appear commonly within four days, but this varies with the number of flies and the season of the year. Natives report that cattle bitten die in greatest numbers before the rains, or when they set in, and that some animals will linger on until then; that having passed a fly country you do not know the full amount of loss until the rainy season has begun.

The number of flies sufficient to kill an ox has been variously estimated: Vardon speaks of ten or a dozen; Mr. Oswell of three or four; Livingstone thinks that not a score of flies were on his oxen. In the absence of direct experiment, this of course is guess-work; it only shows that a small number prove sufficient.

In most Tsetse countries, the traveller is not usually beset with more than two or three at a time; in the course of the heat of the day these might produce a number of bites, besides falling in with fresh flies as one advanced. But they are sometimes found in much greater numbers. On the south side of the Zambezi, near the confluence of the Kafue, while walking along the river bank in search of game, under shady flat-topped acacias, I heard a buzzing sound, and saw a cloud of insects coming towards me. Supposing them a swarm of bees, I ran off, while they followed. On looking back I found it was only "Tsetse;" so, arming myself with a leafy branch, I kept them off and continued my journey; they accompanied me for some distance however. I have never again seen them congregate in this manner; and, curiously enough, on this occasion, and on this only, did I obtain two of what may be the male insect; these bear the proportion to the females of 1:30, judging by the numbers then caught.

The systematic description of the "Tsetse" and its allies having been minutely entered into by Professor Westwood, I shall only add a brief description of the parts composing the mouth or biting apparatus. This consists of four pieces, of which two are lateral setose palpi, for the protection of the proboscis and its contained style. The lateral palpi are equal in length to the horny proboscis, which they embrace when at rest, but are thrown forward in a line with the body of the insect when in the act of sucking. They are of a deep brown colour, almost black at the tips, concave and finely hairy inside, outside convex and furnished with dark setæ, stronger and more numerous at the apex.

What in the common fly is a soft fleshy proboscis, becomes in the genus *Glossina* a straight, horny, chestnut-coloured bristle, smooth and polished, the apex slightly dilated and rounded, the

base expanded into a large horny body of cordate form. The upper surface of this proboscis is grooved nearly to its distal extremity, and contains a slender glassy style, equal to the groove in length, which may be raised from its protecting sheath. This style is the biting instrument; it is convex above, deeply concave beneath, and cut off obliquely at the point; the margins are slightly waved, and near the base furnished with a series of minute pedunculate hairs. Where it joins the proboscis, near the base of the lobed dilated swelling, the edges approximate and form a tube.

In the description of *Glossina longipalpis*, Wied., given by Mocquart, it is suggested that within the grooved style there probably exists a tongue or second part. This Professor Westwood has figured, which in fact has no existence in the "Tsetse."

It has been suggested that the horny dilatation at the base of the proboscis may contain some very strong poison, or a gland for its secretion; on dissection I find in it nothing but a series of large muscular bundles arising from a common tendon attached to the grooved body of the proboscis, some of the muscular bundles embracing and attached at the other end to the membranous œsophagus or continuation of the grooved style.

When in the act of biting, the insect throws forward the two hairy palpi and raises the grooved style from the upper surface of the proboscis, which at the same time is turned backwards; then, by forcing the head down on the animal, the style is inserted,—no doubt in this assisted by the powerful muscular arrangement at its base.

The irritation which follows the bite in man shows that some irritant matter is at the same time injected (although no organ for its secretion has yet been detected), the object of which is no doubt to cause a local congestion, and thus facilitate the sucking of blood. The accidental effects of this, which in animals among whom the "Tsetse" naturally lives produces no after result, in the domestic animals before-named proves fatal.
